"Towards More Affordable and Resilient Space Systems"

A Speech by
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Thank you, and good afternoon.

I am happy to be with you today to share some perspectives on the state of our space industry, and to discuss the challenges we face and the potential directions we could pursue to ensure the U.S. remains the world leader in space. As we are all aware, during recent decades national security space capabilities have become essential to America's military forces, intelligence operations and foreign policy. Since the end of the Cold War, we have seen a transformation of our military into highly mobile, precise and lethal forces, enabled in many respects by a comprehensive array of space capabilities that are integrated into all operating domains – land, sea, air and cyber. We also know that important aspects of our national economy, industrial activity and public safety depend on satellites, both commercial and dual-use space systems, operated and used by the U.S. military and other federal agencies. While space systems and related products and services directly contributed over $150 billion to our country's gross domestic product in 2010, their indirect impact on public services and private businesses generated economic value amounting to several times this total. As a result, our economic well-being as well as our national security and international standing depend on space systems to an extent that would have been unimaginable 50 years ago, at the dawn of the space age.

Today, however, we face an unprecedented set of challenges in providing the space capabilities our country has come to depend upon. Slow economic growth and runaway federal deficits will no doubt put significant pressure on the entire space community. The Pentagon's budget will be reduced by a minimum of half a trillion dollars over the next decade; whether or not near-term agreements are reached in Congress on debt reduction actions, that number will likely grow to over a trillion dollar cut to the total defense budget in the next few years. With all the competing priorities and "must pay" bills, it is a near certainty that national security space programs will face major funding reductions in the years ahead. At the same time, the demands and dependence on space to support our future military strategy and force structure will surely grow. The challenge will be how to continue to do as much, or more, in military space, but with significantly fewer resources.

The last time the space industry faced similar challenges was at the end of the Cold War, when we experienced about a 30% reduction in space program budgets and workforces. The response at that time was substantial industry consolidation, significant reduction in the government's

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acquisition workforce, adoption of consolidated architectures and programs, and widespread reliance on an "acquisition reform" strategy which put major authority in industry but without proportional accountability for program success.

The decisions of the 1990's led to many of the serious problems in recent national security space system acquisition programs. These problems have prevented space capabilities from being as accessible or effective as they might have been. And they continue to threaten their continued vitality and relevance in the longer term. While there have been some improvements by both government and industry, many problems persist today in many major space acquisitions. These are likely to be exacerbated by increasing federal budget pressures and a less friendly space operational environment in the decade ahead.

From my perspective, there are three basic manifestations of these problems:

First, while many of our national security space programs produce highly capable systems with impressive technical performance, individual satellites are frequently very complex and architectures are too often fragile. As a result, several important mission areas are vulnerable to one-failure losses, putting us just a single problem away from serious gaps in critical operational capabilities. This situation is likely to become of even greater concern in the years ahead, as we face an increasingly congested and contested space environment where our adversaries may attempt to reduce the asymmetric advantages the U.S. enjoys in space. These threats may possibly include direct attacks on our satellites and ground systems, as others exploit the vulnerabilities and dependencies in many of our vital space systems.

Second, many of our space programs are characterized by excessively long development cycles and infrequent technology upgrades. It is common for large programs to take a decade to deliver a satellite, and to miss their expected deployment dates by three or four years. In some cases, major systems end up using technology that lags a generation or two behind the available commercial state-of-the-art due to these long development cycles and fielding delays. The opportunities to incorporate technological advances often are few and far between. As a result, one of America's strongest sources of competitive advantage – technological innovation – is undermined, especially in an era when security threats are rapidly evolving. It is also causing serious problems for our space industry base which faces irregular demand, an ageing workforce and an obsolescent technology base.

Third, many national security space programs have very high and inherently unpredictable acquisition costs. In recent years, some individual satellites have cost well in excess of $1 billion, partly the result of average unit cost overruns greater than 100% in the 10 largest space programs. The costs of intermediate and heavy launchers have also escalated rapidly. Altogether, there have been over 15 Nunn-McCurdy breaches in the 10 largest satellite and rocket programs during the past decade alone, straining the credibility of our industry in the Pentagon and Congress.

So how did we get into this situation? No one would argue that the space professionals making and implementing system acquisition decisions in the 1980's and 1990's were not experienced or dedicated. Rather, the opposite, in fact was true: the technical, operational and fiscal

circumstances in past decades – from early dependence on the Space Shuttle for space access, to the achievable performance from then-available technologies, to the newly-emerging strategic and tactical demands for space capabilities – drove them to a completely logical and consistent set of choices for space system architectures and acquisition programs. Indeed, the realities they faced almost demanded the decisions that were made.

However, the unintended consequences of those decisions have led to serious, systemic problems in today's space programs. We face a "vicious cycle" of actions and consequences which collectively lead to capabilities which are too costly, take too long to deliver, and are technically obsolescent, with a workforce that is ageing and an industry base that is fragile and isolated from broader sources of technological advances. These are the new realities we face, and they now require new thinking and different actions.

Fortunately, we now have a better set of options in the future architectures we pursue and the ways we choose to develop and deliver national security space systems. These options involve fundamental changes in both what is purchased and how it is bought. Adopting these changes in a manner so as to maintain the continuity of existing critical functions will not be easy, nor will the inertia of the status quo naturally give way to new ideas. But the imperatives for change demand that we embrace new ideas and adopt new approaches, as the prospects for severe budget cuts and truly contested space operations are real and immediate.

In my view, a better alternative for space architectures – which define "what" is to be bought and deployed – is to disaggregate capabilities among smaller, less complex and more numerous platforms. This would reverse the trend, which has been at least 30 years in the making, of concentrating major capabilities on larger, more complex and powerful, but fewer spacecraft. Such a distributed approach would feature single- or, at most, dual-payload systems optimized for a specific mission. It would apply advanced payload and platform technologies to simplify systems and reduce their costs, instead of pushing for the last 10% of possible technical performance. This approach would naturally result in faster, less risky development cycles and would allow for more frequent opportunities to update key subsystem and payload technologies. It would also lead to smoother, more continuous production programs and more predictable demand for the supply chains of space system integrators. Because individual satellites would be smaller and less expensive, launch vehicle lift capacity would not be pushed to the upper bounds of performance and cost. For similar reasons, mission assurance activities would be more affordable as well. Finally, such disaggregated and distributed architectures would also be more survivable and flexible, and in some cases more conducive to international participation.

In a similar way, the better alternative for acquisition practices – the "how" of such purchases – would be based on the relevant directives in recent DoD efficiency guidelines, foremost among them being the emphasis on affordability as a first-order factor in military purchase decisions. To make this work, the space industry will have an obligation to identify those system designs that can achieve "90% solutions" in return for substantial cost savings. For their part, government agencies will have a related obligation to fully consider commercial systems and practices, which will often mean reducing government-unique technical standards and low-added-value compliance requirements, reviews, reports and audits. Similarly, industry will need to be prepared to stand behind its cost and schedule commitments with commercial-type

contracts that put its profit on the line for poor performance, and government will need to structure procurements in ways that promote effective competition within a more diverse and innovative industrial base.

There are reasons for cautious optimism that these kinds of new system architectures and acquisition practices can effectively perform a wide range of major national security space missions, and can begin to do so within the next five years. There is also good evidence that such approaches will be substantially more affordable and resilient than those of current main-line space programs. And if we are smart and disciplined in the way we go about managing them, I believe it will be possible to avoid the mistakes of "acquisition reform" attempts in the 1990's, including unacceptable reductions in mission success for the military and inadequate profitability for industry.

Let me cite three examples of recent progress in such alternative architectures and acquisition practices that strongly suggest that practical, affordable and resilient capabilities can be fielded on a large scale by the second half of this decade:

First, important technology advances have occurred during the last 10 years in a range of mission payloads that enable less complex and less expensive approaches to demanding national security missions. Sponsored by the Air Force as well as the NRO, DARPA and other agencies, these advances have been wide-ranging: from staring IR sensors and large, agile focal plane arrays, to adaptive mirror technology and space-qualified electronically-steered antennas, to space-to-space and space-to-ground laser communications, and massive on-board data processing and storage.

Second, successful technology demonstrations and operational adjunct missions have been carried out by various government agencies and their industry partners over the last five years, with still more due for launch soon. These programs, a number of which have achieved quite impressive results, have not only raised the maturity levels of key payload technologies, but also have reconfirmed our ability to conduct fast-cycle, lower-cost acquisitions that produce serious new military and intelligence capabilities.

Third, commercial satellite platforms have continued to improve in efficiency, reliability and longevity, while their manufacturing processes and operations methods have also steadily improved. By quickly incorporating incremental technology advances and building 12-15 satellites a year on 2-3 year order-to-delivery cycles, the three primary U.S. commercial spacecraft builders – Boeing, Loral and Orbital – have reduced the capital cost to produce and deploy a unit of communications capacity by an average of 10-12% a year, year in and year out, for the last three decades. Having built Orbital's business for 30 years at the crossroads of commercial, civil government and national security space markets, I have seen the powerful effects of this "virtuous cycle" at work: regular design and manufacturing cadence, steady product improvements, robust supply chains, short cycle times, and disciplined cost management. Taken together, these forces have resulted in a 25-fold improvement in the cost-per-transponder-year of commercial satcom capacity since 1980.
Now it is time to consolidate and apply these advances more broadly to our national security space programs. We need not wait 10 years or longer to do this. Instead, there are practical and prudent opportunities we can capitalize on in the next few years to make critical military and

intel space capabilities both more affordable and more resilient. Disaggregated system architectures and new acquisition practices can be adopted in mission areas ranging from missile warning, milsatcom and weather monitoring to electro-optical imaging, electronic intelligence and space situational awareness, to achieve these outcomes sooner rather than later. I note these examples, and could add others like them, not to suggest that we set our sights lower for future national security capabilities, but instead to underscore that we really can chart a course to more dependable, flexible and affordable space systems now, not at some distant future date.

To sum up: The challenges the space community faces today are indeed a "perfect storm" – especially the nearly certain historic downturn in federal spending and the potential emergence of serious threats to our freedom of action in space. Fortunately, these challenges are well-matched by exciting new possibilities that are before us – possibilities based on new technologies, new architectures and new acquisition approaches. Together, these factors make this the critical time to chart new directions for the national security space community. In this regard, I am very happy to see the continued emphasis by Gen Kehler and across STRATCOM, as well as the Air Force Space Command, in tackling the hard questions about how to do this, and examining realistic and effective answers to them.

I will close with a two-part challenge to all of us: First, to our Government leaders, you should be impatient; insist on major changes in space system affordability and resilience in the coming few years, not in a vague future "beyond the FYDP." And second, to our industry executives, we should stop protecting the status quo when it no longer best serves the defense and economic interests of our country; instead, we must provide more innovative and affordable alternatives, for which we will be accountable, and of which we can be proud.

Thank you.